Lawrence Berkeley National Laboratory - University of California

ENGINEERING NOTE

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Mechanical Engineering	**05/13/2004**

Project: **LHC IR FEEDBOX (DFBX)**

Title: LIQUID HELIUM VESSEL DIAGNOSTIC PROBE FABRICATION TRAVELER

1. SCOPE

This document specifies the assembly details of the diagnostic probe that will be installed in the LHC IR Region Feedboxes (DFBX). The probe contains 2 liquid helium level sensors (one is 400 mm long and the other is 100 mm long), 2 cartridge heaters (each provides about 50 W when operated at 240 Vac), and one Cernox temperature sensor. The probe will be used by CERN to monitor cooldown and maintain proper level of the liquid helium in the DFBX. The top level assembly is shown on LBNL drawing 27A412.

The probes will be installed into the DFBX by Meyer Tool & Mfg, the DFBX Fabrication Vendor.

2. SPECIAL CONCERNS

2.1 Heater Voltage

The heaters are powered by 240 Vac through a small connector where the pin-pin and pin-ground spacing is about 1 mm. In order to prevent electrical flashover, we have to pot the helium side with epoxy.

2.2 Liquid Level Readings

We need to accurately position of the liquid level sensors with respect to the mating conflat flange so CERN can maintain proper control of the liquid helium level during LHC operation.

2.3 Cernox Temperature Sensors

The Cernox temperature sensors (supplied by CERN) are individually calibrated and assigned a serial number. CERN provided a traveler that must be filled out for each thermometer. The electrical feedthrough flanges (supplied by CERN) have a serial number etched on their outer surface, so we must make a record of the thermometer-feedthrough flange association.

3. CERNOX THERMOMETER CABLE CONNECTION

Refer to Appendix A, CERN Assembly Procedure LHC-QIT-AP-0002 rev1.0, pages 19-28, for overall guidance and documentation requirements for thermometer electrical hookup. The thermometer used in the DFBX helium bath is CERN type ST.

The parts kit corresponding to each ST-Cernox thermometer installation are contained in a single plastic box. The kit consists of a thermometer (Cernox chip mounted in the ST configuration), a cover plate, thermometer cable, cable label, and Traveler.

In two of the boxes supplied by CERN, CX_LS_X18374 and CX_LS_X18375, the thermometer cable is attached to the sensor package and serves as examples of how we must connect the remaining 6 thermometers to their thermometer cables.

Extension wires are attached to the connector as shown on LBNL drawing 27A408A. Our extension wires are contained in a cable purchased from Habia and have the following differences from the CERN Traveler:

Wire: 26 AWG vs. 24 AWG
Insulation: Kapton vs. Polyolefin
Length: 24 inch vs 8 cm (3.15 inch)
U+ (V+) Color: Blue vs. Black
I+ Color: White vs Yellow .

These differences are not at all significant.

The connection of the thermometer cable to extension wires is covered in the Assembly Instructions on LBNL drawing 27A411A.

For measurements of 2 and 4 wire resistances we will use a HP multimeter, Model 3478A, which is equivalent to the Agilent 34401A mentioned in Appendix A from the standpoint of accuracy and excitation current.

Fill in the pertinent sections of the CERN Traveler for each thermometer and attach a copy of it to LBNL Traveler found in Appendix B.

4. LEVEL SENSOR HOOKUP

LBNL drawing 27A412A shows the proper position of the liquid level sensors. Document that correct positioning was done on the LBNL Traveler in Appendix B.

Hookup of the liquid helium level sensors (supplied by CERN) is covered by Assembly instructions on LBNL drawing 27A411A. The sensors were serialized at LBNL, and after installation are checked with 2-wire resistance measurements using the HP 3478A multimeter. Measure resistances between the Pins listed below on the 16-pin connector and record on the LBNL Traveler in Appendix B:

400-mm-long sensor: A to B, A to C, A to D, B to C, B to D, and C to D

100-mm-long sensor: E to F, E to G, E to H, F to G, F to H, and G to H

level sensor - level sensor cross talk: A to E (should be very large)

level sensor - thermometer cross talk: A to J, and E to J (should be very large)

5. HEATER HOOKUP

Hookup of the electrical heaters is covered by Assembly instructions on LBNL drawing 27A411A. Make the following electrical measurements on the 4-pin connector and record results in the LBNL Traveler in Appendix B:

Heater resistance (2-wire method): A to B and C to D

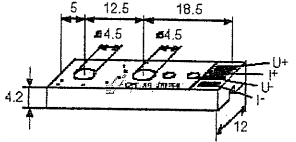
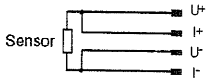
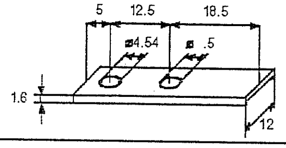
In air, before the connector is epoxy potted:
Heater Hipot (~~1500~~ 720 V V ac): Pins A+B to C+D, Pins A+B to Ground, Pins C+D to Ground
Note: 1500 Vac is the connector rating. Since the heaters are limited to about 1000 V
In helium, after the connector is epoxy potted:
Heater Hipot (720 V ac): Pins A+B to C+D, Pins A+B to Ground, Pins C+D to Ground
Note: 720 Vac is 3 x Operating Voltage. Ensure pure helium atmosphere by testing in leak test chamber. Evacuate and backfill with pure, dry helium. Repeat this 2 more times for a total of three purges. Hipot with the helium pressure at 14.7 psia (0 psig).

Hipot Procedure: Apply voltage for 1 hour; leakage current to be less than 50×10^{-6} A dc.

APPENDIX A: CERN THERMOMETER ASSEMBLY PROCEDURE

5. SHORT THERMOMETER

5.1 SPECIFICATIONS

<table>
<tr><td><i>Short Code</i></td><td colspan="6">ST</td></tr>
<tr><td><i>Application</i></td><td colspan="6">In liquid or gaseous cryogenic environment</td></tr>
<tr><td><i>Serial Number</i></td><td colspan="6">The serial number is marked on the short thermometer and is composed like follow: <i><Sensor>_<Manufacturer>_<Number></i></td></tr>
<tr><td><i>Mechanical Design</i></td><td colspan="6">Top view:

 </td></tr>
<tr><td><i>Electrical Scheme</i></td><td colspan="6">
 </td></tr>
<tr><td rowspan="8"><i>Electrical Data (typ.)</i></td><td rowspan="2"></td><td rowspan="2"><i>Thermometer</i></td><td rowspan="2"><i>Sensor Model</i></td><td colspan="3"><i>Temperature</i></td></tr>
<tr><td><i>Tamb</i></td><td><i>77 K</i></td><td><i>4.2 K</i></td></tr>
<tr><td><i>R(U+,I+)/?2 W</i></td><td>n. a.</td><td>n. a.</td><td>0.1 ... 0.5</td><td>0.1 ... 0.5</td><td>0.1 ... 0.5</td></tr>
<tr><td><i>R(U-,I-)/?2 W</i></td><td>n. a.</td><td>n. a.</td><td>0.1 ... 0.5</td><td>0.1 ... 0.5</td><td>0.1 ... 0.5</td></tr>
<tr><td rowspan="4"><i>R(U+, I+, U-, I-)/?4 W (Excitation current)</i></td><td>CRT_AB_...</td><td>100 ?, 1/8W</td><td>100 ± 3 (0.1 mA)</td><td>120 ± 15 (0.1 mA)</td><td>1000 ± 250 (1 µA)</td></tr>
<tr><td>CRT_JINR_...</td><td>TVO</td><td>900 ± 20 (0.1 mA)</td><td>1300 ± 150 (10 µA)</td><td>4500 ± 1.5k (1 µA)</td></tr>
<tr><td>CX_LS_...</td><td>XCX-1050 -SD-30</td><td>50 ± 20 (0.1 mA)</td><td>180 ± 55 (10µA)</td><td>3600 ± 2k (1µA)</td></tr>
<tr><td>PRT_...</td><td>PT100</td><td>108 ± 0.2 (1mA)</td><td>20 ± 0.7 (1mA)</td><td>n. a.</td></tr>
<tr><td><i>Cover</i></td><td colspan="6">A mechanical protection cover shall be fixed on the thermometer.
Top view:

 </td></tr>
</table>

The electrical data refers to the short thermometer only (cable not included).

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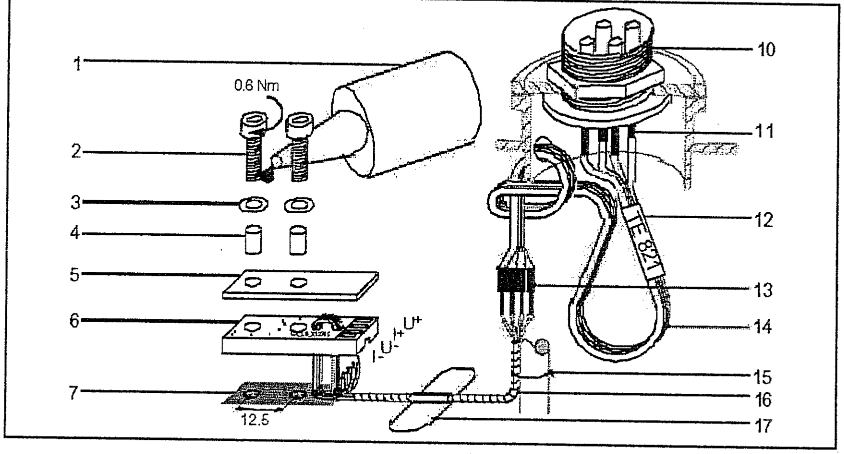
LHC-QIT-AP-0002 rev 1.0

5.2 FIXING

The short thermometer can be fixed in three different ways. A polyimide foil shall be sandwiched between thermometer and mounting surface to avoid electrical damage of the sensor in case the surface is under high electric potential.

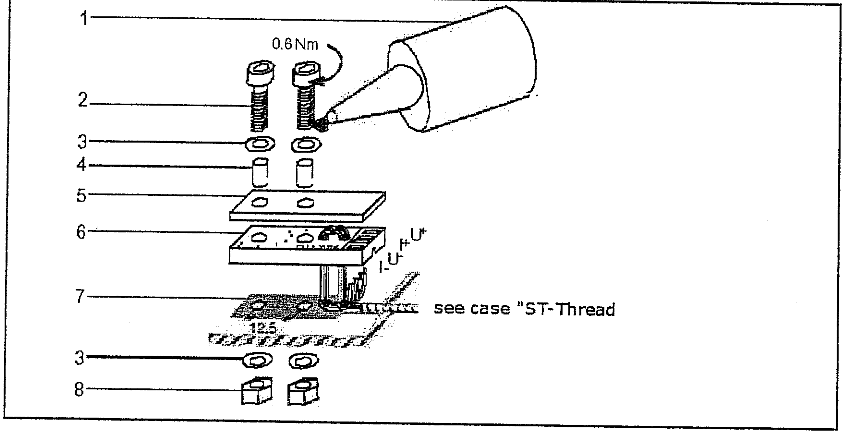
5.2.1 CASE "ST-THREAD"

On the mounting surface 2 threaded holes are necessary to block the screws.



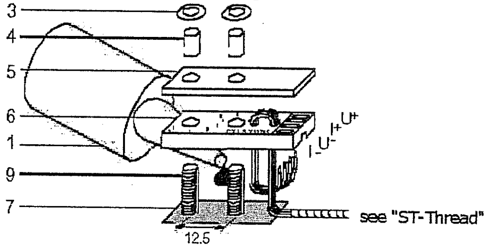
5.2.2 CASE "ST-HOLE"

If the mounting surface is a thin sheet were no threading can be done, than simply two holes are needed, to fix the thermometer with 2 screws and nuts.



5.2.3 CASE "ST-STUD"

If no hole can be drilled in the mounting surface, studs have to be welded.



List of parts:

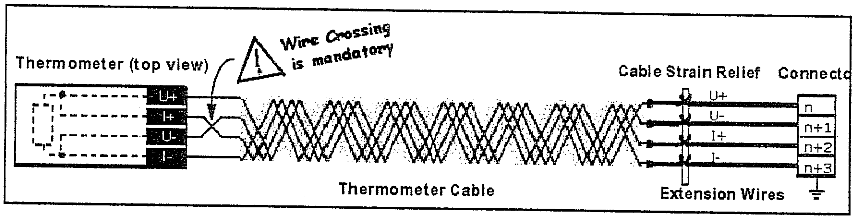
Pos	*Part*	*Details*	*Supplier*	*Model*	*CERN-SCEM*
1	Glue	Screw glue	LOCTITE	Loctite® 245	37.30.35.074.3
2	Screw	M4 x 10, Stainless steel	-	-	47.62.71.154.8
3	Washer	Curved spring, phosphor bronze	-	-	47.78.08.607.4
4	Tube	Polyimide Tube			
5	Cover	Short thermometer cover	CERN	-	-
6	Thermometer	Short thermometer	CERN	-	-
7	Foil	Polyimide Foil 0.07 mm x 12 mm x 36 mm			04.94.70.100.3
8	Nut	M4, Stainless steel	-		47.43.77.040.1
9	Stud	M4 x 10, Steel	-	-	47.62.97.154.4
10	Connector	-	-	-	-
11	Sleeve*	Heat shrinkable, ø=1.6 mm	RAYCHEM	RT-102	-
12	Label*	Shrinkable, ø=3.4 mm, yellow		Halogen free	-
13	Sleeve*	Heat shrinkable, ø=1.6 mm	RAYCHEM	RT-102	-
14	Wire*	Extension wires, black	HUBER-SUHNER	0.25 mm²	04.01.61.340.1
		Extension wires, red	HUBER-SUHNER	0.25 mm²	04.01.61.370.5
		Extension wires, yellow	HUBER-SUHNER	0.25 mm²	04.01.61.390.1
		Extension wires, green	HUBER-SUHNER	0.25 mm²	04.01.61.310.7
15	Lace	Linen	GRUSCHWITZ	18/7	04.76.81.007.2
16	Cable	Thermometer cable for type ST	AXON'	HT 3007 H4	-
17	Tape	Aluminium, width=19 mm	TESA	4500	04.95.20.219.8

* shall be in accordance with CERN Safety Instruction IS 23.

5.3 CABLING

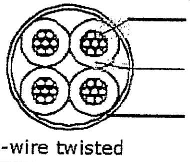
5.3.1 DIAGRAM

The resistance of the temperature sensor is measured in the Ω4W-way. Therefore a 4-wire twisted "thermometer cable" is soldered to the thermometer. To minimalize heat flow from ambient environment to the sensor by conduction of the electrical leads, thin wires are used. Stress on those thin wires is avoided by more robust extension wires, which are mechanically fixed (f.e. by a knot) close to the connector. The cabling looks like follows.



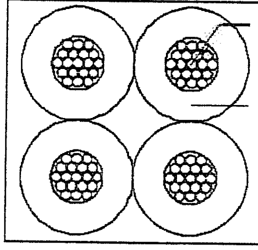
The electrical connections on the thermometer and connector do NOT follow the same order!

5.3.2 SHORT THERMOMETER CABLE


4-wire twisted

Wire: copper, silver-plated, AWG 30 (0.056 mm^2), $\lambda(4\ K) = 300\ W/(m\ K)$, $\rho(300\ K) = 0.32$?/m
Insulation: polyimide, ø=0.6 mm, black=U+, red=U-, yellow=I+, green=I-
Jacket: wrapped polyimide, ø=1.7 mm
Function: low heat-in leak

5.3.3 EXTENSION WIRES



Wire: copper, silver-plated, AWG 24 (0.239 mm^2), $\lambda(4\ K) = 300\ W/(m\ K)$, $\rho(300\ K) = 0.07$?/m

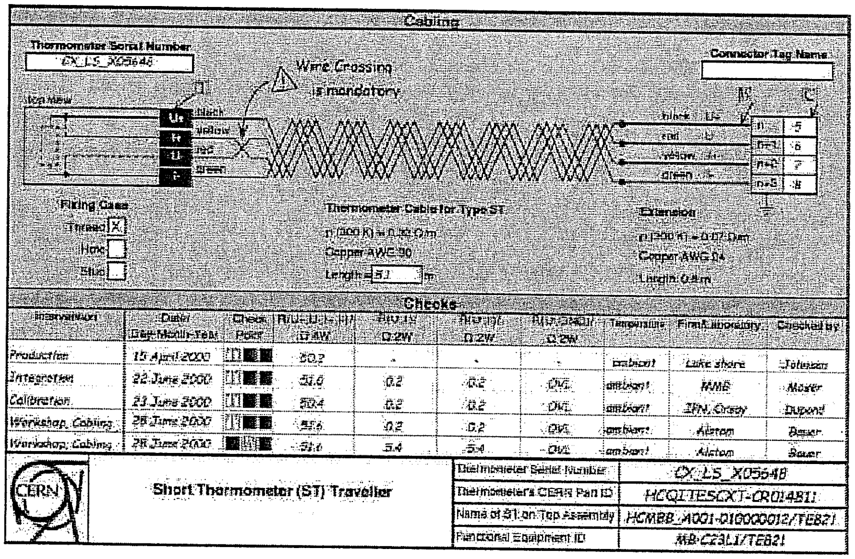
Insulation: polyolefine, ø = 1.5 mm, colour like thermometer cable

Jacket: -
Function: cable strain relief by making a loop

5.4 THERMOMETER TRAVELLER

Every thermometer has its specific "Thermometer Traveller"-sheet, like a curriculum vitae. This traveller traces the life of the thermometer.

Example:



Thermometer Serial Number: CX_LS_X05648

Fixing Case
Thread ☒
Hole ☐
Stud ☐

Thermometer Cable for Type ST
ρ(300 K) = 0.30 Ω/m
Copper AWG 30
Length = 31 m

Extension
ρ(300 K) = 0.07 Ω/m
Copper AWG 24
Length 0.8 m

Checks

Intervention	Date Day-Month-Year	Check Point	R(U+,U-,I+,I-) Ω 4W	R(U I+) Ω 2W	R(U- I-) Ω 2W	R(U, Shield) Ω 2W	Temperature	Firm/Laboratory	Checked by
Production	15 April 2000	☐■■	50.2	-	-	-	ambient	Lake shore	Johnson
Integration	22 June 2000	☐■■	51.0	0.2	0.2	OK	ambient	MMB	Moser
Calibration	23 June 2000	☐■■	50.4	0.2	0.2	OK	ambient	IPN, Orsay	Dupond
Workshop, Cabling	28 June 2000	☐■■	55.6	0.2	0.2	OK	ambient	Alstom	Bauer
Workshop, Cabling	28 June 2000	■☐■	51.6	5.4	5.4	OK	ambient	Alstom	Bauer

CERN **Short Thermometer (ST) Traveller**

Thermometer Serial Number	CX_LS_X05648
Thermometer's CERN Part ID	HCQITESCXT-CR014811
Name of ST on Top Assembly	HCMBB_A001-01000012/TE821
Functional Equipment ID	MB-C23L1/TE821

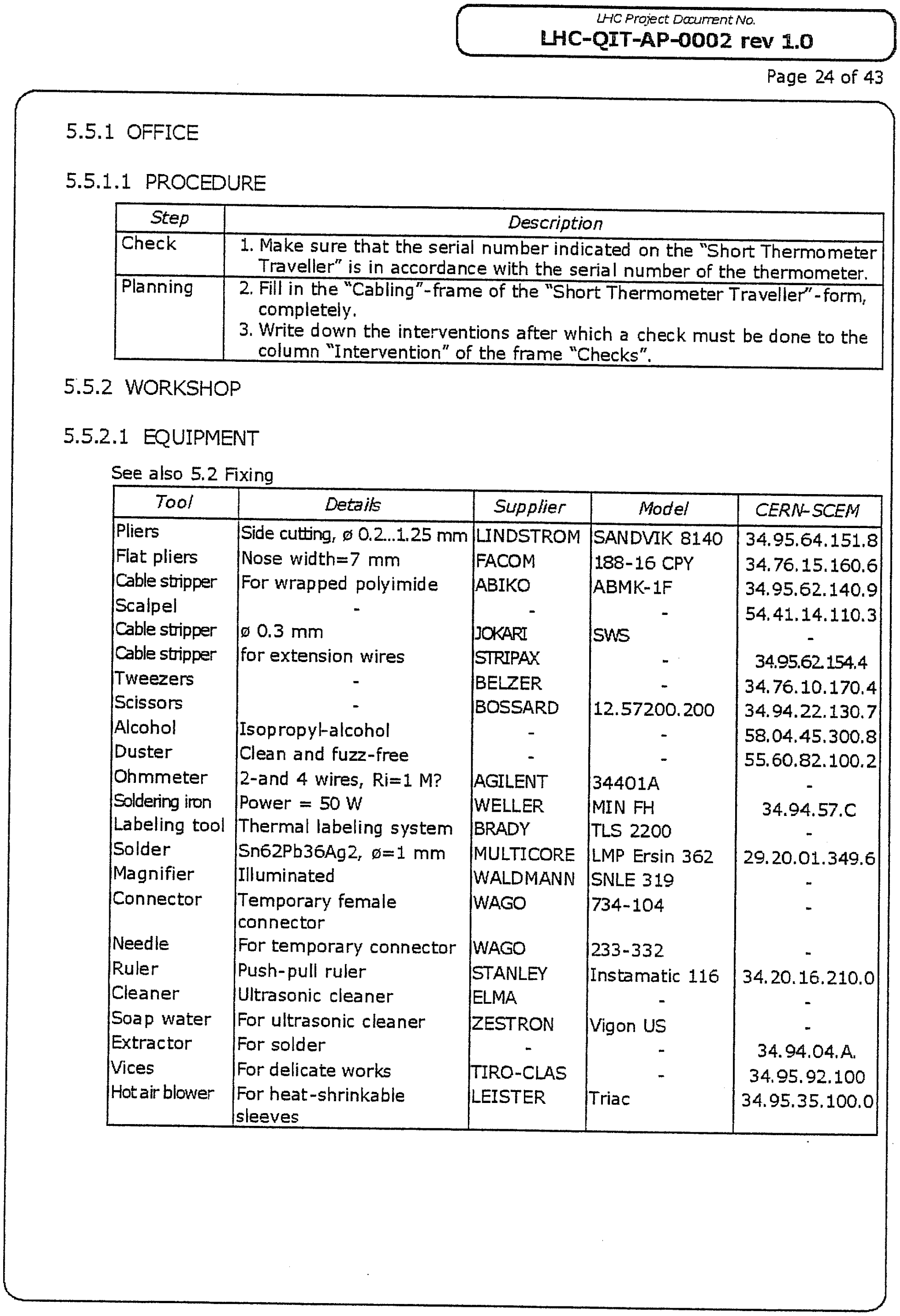
⚠ **After every mechanical or electrical intervention the checks indicated on the traveller shall be done and filled in.**

5.5 INSTALLATION PROCEDURE

The installation procedure of a short thermometer is divided in 4 consecutive phases:

Order	Phase	Main Activity
1	Office	Allocation of the thermometer
2	Workshop	Wire attachment to thermometer
3	On Site, Fixing	Fixing of the thermometer
4	On Site, Cabling	Cabling

During all the phases the thermometer traveller is an important tool to check the well functioning of the thermometer.



5.5.1 OFFICE

5.5.1.1 PROCEDURE

Step	*Description*
Check	1. Make sure that the serial number indicated on the "Short Thermometer Traveller" is in accordance with the serial number of the thermometer.
Planning	2. Fill in the "Cabling"-frame of the "Short Thermometer Traveller"-form, completely. 3. Write down the interventions after which a check must be done to the column "Intervention" of the frame "Checks".

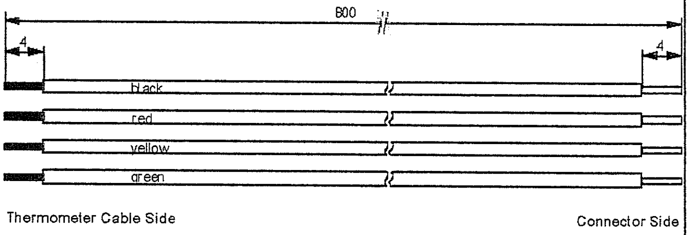
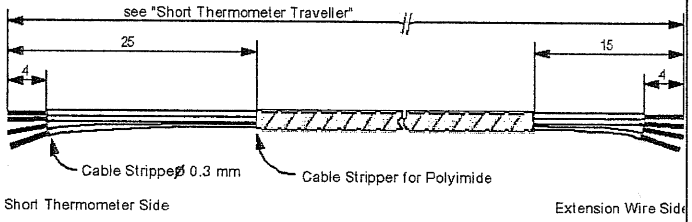
5.5.2 WORKSHOP

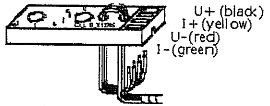
5.5.2.1 EQUIPMENT

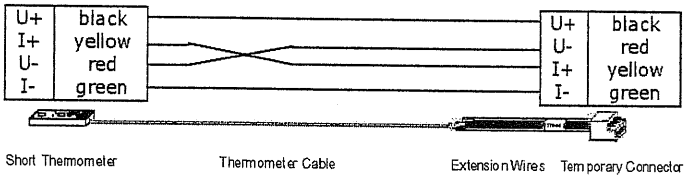
See also 5.2 Fixing

Tool	*Details*	*Supplier*	*Model*	*CERN-SCEM*
Pliers	Side cutting, ø 0.2...1.25 mm	LINDSTROM	SANDVIK 8140	34.95.64.151.8
Flat pliers	Nose width=7 mm	FACOM	188-16 CPY	34.76.15.160.6
Cable stripper	For wrapped polyimide	ABIKO	ABMK-1F	34.95.62.140.9
Scalpel	-	-	-	54.41.14.110.3
Cable stripper	ø 0.3 mm	JOKARI	SWS	-
Cable stripper	for extension wires	STRIPAX	-	34.95.62.154.4
Tweezers	-	BELZER	-	34.76.10.170.4
Scissors	-	BOSSARD	12.57200.200	34.94.22.130.7
Alcohol	Isopropyl-alcohol	-	-	58.04.45.300.8
Duster	Clean and fuzz-free	-	-	55.60.82.100.2
Ohmmeter	2-and 4 wires, Ri=1 M?	AGILENT	34401A	-
Soldering iron	Power = 50 W	WELLER	MIN FH	34.94.57.C
Labeling tool	Thermal labeling system	BRADY	TLS 2200	-
Solder	Sn62Pb36Ag2, ø=1 mm	MULTICORE	LMP Ersin 362	29.20.01.349.6
Magnifier	Illuminated	WALDMANN	SNLE 319	-
Connector	Temporary female connector	WAGO	734-104	-
Needle	For temporary connector	WAGO	233-332	-
Ruler	Push-pull ruler	STANLEY	Instamatic 116	34.20.16.210.0
Cleaner	Ultrasonic cleaner	ELMA	-	-
Soap water	For ultrasonic cleaner	ZESTRON	Vigon US	-
Extractor	For solder	-	-	34.94.04.A.
Vices	For delicate works	TIRO-CLAS	-	34.95.92.100
Hot air blower	For heat-shrinkable sleeves	LEISTER	Triac	34.95.35.100.0

5.5.2.2 PROCEDURE

Step	*Description*
Start checks	4. Make sure that the serial number indicated on the "Short Thermometer Traveller" is in accordance with the serial number of the thermometer. 5. Measure R(U+, U-, I+, I-), R(U+, I+), R(U-, I-) and R(U+, GND) at the thermometer "Check Point T". 6. Write the measured values to the "Short Thermometer Traveller". 7. Check if measured values are in accordance with the values in the first line ± 3 ?.
Preparation extension wires	8. Cut four extension wires by a length of approx. 800 mm with side 9. cutting pliers. 10. Strip the extension wires with the appropriate tool. Tin the wires on the thermometer cable side, only. 
Preparation thermometer cable for type ST	11. Cut the thermometer cable for type ST by the length indicated on the "Short Thermometer Traveller" with side cutting pliers. 12. Strip the thermometer cable. 13. Tin the wires of the thermometer cable on both ends. 
Soldering cable	14. Fix the short thermometer cable carefully with vices. 15. Solder the 4 extension wires to the short thermometer cable colour by colour with solder Sn62Pb36Ag2. Don't exceed a temperature of 250 ^{o}C.
Fixing temp. connector	16. Write the name of the thermometer TE... (see "Short Thermometer Traveller") on the heat shrinkable label ø 3.4 mm. 17. Shrink label over the 4 extension wires with hot air blower. 18. Clip temporary connector to the extension wires with needle tool.

<table>
<tr><td>Soldering thermometer</td><td>19. Create a strain relief by passing the thermometer cable through the two, small holes of the thermometer.


20. Solder wires of the thermometer cable to the short thermometer with low melting point solder Sn62Pb36Ag2. Don't exceed a temperature of 250 °C.

 </td></tr>
<tr><td>Cleaning</td><td>21. Put the thermometer and the soldered cable in an ultrasonic cleaner with soap water of 20 °C for 3 minutes, and then rinse with deionsed water for 3 minutes.</td></tr>
<tr><td>Shrinking sleeves</td><td>22. Protect the soldering by shrinking 4 sleeves ø1.6 mm x 10 mm with hot air blower.</td></tr>
<tr><td>End checks</td><td>23. Measure R(U+, U-, I+, I-), R(U+, I+), R(U-, I-) and R(U+, GND) at the temporary connector "Check Point W".
24. Write the measured values to the "Short Thermometer Traveller".
25. Check if measured values are in accordance with the values in the first line ± 3 ?.
26. Put the short thermometer with the attached cable, the cover and the "Short Thermometer Traveller"-Sheet in the transport case.</td></tr>
</table>

5.5.3 ON SITE, FIXING

5.5.3.1 EQUIPMENT

See also 5.2 Fixing

Tool	*Details*	*Supplier*	*Model*	*CERN-SCEM*
Duster	Clean and fuzz-free	-	-	55.60.82.100.2
Alcohol	Isopropyl-alcohol	-	-	58.04.45.300.8
Lamp	Safety wander-lamp, 220 V	-	-	03.52.10.620.2
Scissors	-	BOSSARD	12.57200.200	34.94.22.130.7
Screwdriver	Torque-limiting 0.6 Nm	MHH Engineering	Torqueleader	-
Ohmmeter	2-and 4 wires, Ri = 1 M?	HP	-	-
Connector	Temporary male connector	WAGO	733-204	-
Cable	Extension cable, 220 V	-	-	04.66.11.230.9

5.5.3.2 PROCEDURE

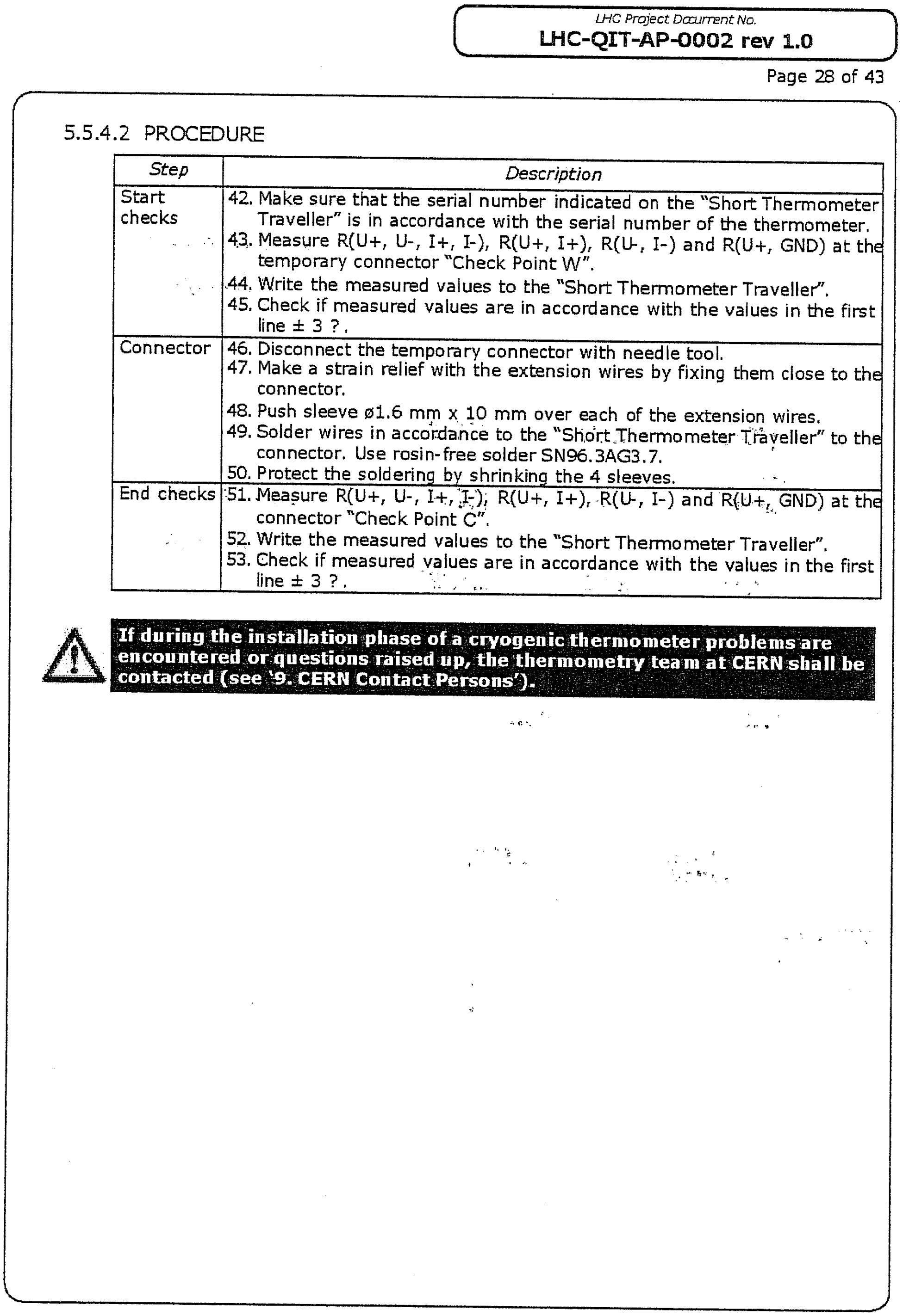
Step	*Description*
Start checks	27. Make sure that the serial number indicated on the "Short Thermometer Traveller" is in accordance with the serial number of the thermometer. 28. Make also sure that the fixing case indicated on the "Short Thermometer Traveller" is in accordance with the fixing case on site. 29. Measure R(U+, U-, I+, I-), R(U+, I+) R(U-, I-) and R(U+, GND) at the temporary connector "Check Point W". 30. Write the measured values to the "Short Thermometer Traveller". 31. Check if measured values are in accordance with the values in the first line ± 3 ?.
Fixing thermometer	32. Clean the mounting surface. 33. Place the thermometer on its final position. Don't squeeze the cable! 34. Place the cover on top of the thermometer. 35. Put a drop of screw glue on the screws or studs. 36. Put the curved spring washers. 37. Screw the thermometer with a torque of 0.6 Nm.
Fixing cable	38. Fix the cable at every change of direction, at least every 50 cm with easy tighten slopes of lace. Leave the cable lose between the fixings! Where fixing with lace is not possible, use edge-rounded aluminium-tape after cleaning the surfaces with isopropyl alcohol.
End checks	39. Measure R(U+, U-, I+, I-), R(U+, I+) R(U-, I-) and R(U+, GND) at the temporary connector "Check Point W". 40. Write the measured values to the "Short Thermometer Traveller". 41. Check if measured values are in accordance with the values in the first line ± 3 ?.

5.5.4 ON SITE, CABLING

5.5.4.1 EQUIPMENT

See also 5.2 Fixing

Tool	*Details*	*Supplier*	*Model*	*CERN-SCEM*
Lamp	Safety wander-lamp, 220 V	-	-	03.52.10.620.2
Soldering iron	Power = 50 W	WELLER	-	34.94.57.350.2
Solder	SN96.3AG3.7, rosin-free	KESTER	-	-
Hot air blower	For heat-shrinkable sleeves	RAYCHEM	CV1981	34.95.35.100.0
Ohmmeter	2-and 4 wires, Ri = 1 M?	HP	-	-
Connector	Temporary male connector	WAGO	733-204	-
Needle	For temporary connector	WAGO	233-332	-
Test box	With connector for test	-	-	-
Cable	Extension cable, 220 V	-	-	04.66.11.230.9



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5.5.4.2 PROCEDURE

Step	*Description*
Start checks	42. Make sure that the serial number indicated on the "Short Thermometer Traveller" is in accordance with the serial number of the thermometer. 43. Measure R(U+, U-, I+, I-), R(U+, I+), R(U-, I-) and R(U+, GND) at the temporary connector "Check Point W". 44. Write the measured values to the "Short Thermometer Traveller". 45. Check if measured values are in accordance with the values in the first line ± 3 ?.
Connector	46. Disconnect the temporary connector with needle tool. 47. Make a strain relief with the extension wires by fixing them close to the connector. 48. Push sleeve ø1.6 mm x 10 mm over each of the extension wires. 49. Solder wires in accordance to the "Short Thermometer Traveller" to the connector. Use rosin-free solder SN96.3AG3.7. 50. Protect the soldering by shrinking the 4 sleeves.
End checks	51. Measure R(U+, U-, I+, I-), R(U+, I+), R(U-, I-) and R(U+, GND) at the connector "Check Point C". 52. Write the measured values to the "Short Thermometer Traveller". 53. Check if measured values are in accordance with the values in the first line ± 3 ?.

If during the installation phase of a cryogenic thermometer problems are encountered or questions raised up, the thermometry team at CERN shall be contacted (see '9. CERN Contact Persons').

APPENDIX B: LHE VESSEL DIAGNOSTIC PROBE TRAVELERS

LIQUID HELIUM VESSEL DIAGNOSTIC PROBE TRAVELER

VIBROMETER FLANGE SER	AA 76390

"0" LEAK RATE: 4.2 X10-10 STD CC/SEC (HELIUM) BY D. ANDERSON, DATE 8/17/04

USED IN	DFBX B
CERNOX SERIAL NUMBER	CS-LS-X 18374
(ATTACH COPY OF COMPLETED CERN TRAVELER)	
LEVEL SENSOR SERIAL NUMBERS	HD100- _ , HD400-_
LEVEL SENSORS POSITIONED PER 27A412A	D. ANDERSON (SIGNED) 8/12/04 (DATE)

LEVEL SENSOR RESISTANCE CHECKS (2-WIRE HP 3478A)
(16-PIN CONNECTOR)

A TO B: 76.09	A TO C: 2.46	A TO D: 75.37
B TO C: 78.12	B TO D: 1.48	C TO D: 77.43
E TO F: 20.00	E TO G: 4.06	E TO H: 20.25
F TO G: 23.54	F TO H: .75	G TO H: 23.79

A TO J: OVL MOHMS	E TO J: OVL MOHMS

D. ANDERSON
(SIGNED)
8/12/04
(DATE)

HEATER ELECTRICAL CHECKS
(4-PIN CONNECTOR)

A TO B: ~~OVL.~~ .578	C TO D: .556

750 VAC BEFORE POTTING, IN AIR,
~~1500 VAC~~ A+B TO C+D FOR I HR OK? ✓ Y ___ N
750 ~~1500~~ VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
750 ~~1500~~ VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

D. ANDERSON
(SIGNED)
8/23/04
(DATE)

AFTER POTTING, IN HELIUM,
720 VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
720 VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
720 VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

REVIEWED Jon Zbasnik DATE 8/31/04
JON ZBASNIK
APPROVED DATE 9/1/04
JOSEPH RASSON

LIQUID HELIUM VESSEL DIAGNOSTIC PROBE TRAVELER

VIBROMETER FLANGE SER: AA_76409

"0" LEAK RATE: 1.4 X10^{-9} STD CC/SEC (HELIUM) BY ANDERSON, DATE 8-19-04

USED IN: DFBX H

CERNOX SERIAL NUMBER: CS-LS-X 18379

(ATTACH COPY OF COMPLETED CERN TRAVELER)

LEVEL SENSOR SERIAL NUMBERS: HD100- 7, HD400- 7

LEVEL SENSORS POSITIONED PER 27A412A — DAVE ANDERSON (SIGNED) 6/21/04 (DATE)

LEVEL SENSOR RESISTANCE CHECKS (2-WIRE HP 3478A)
(16-PIN CONNECTOR)

A TO B: 76.31	A TO C: 2.59	A TO D: 75.61
B TO C: 78.47	B TO D: 1.53	C TO D: 77.72

E TO F: 19.56	E TO G: 3.13	E TO H: 19.34
F TO G: 22.30	F TO H: .656	G TO H: 22.09

A TO J: OVL MOHMS | E TO J: OVL MOHMS

DAVE ANDERSON (SIGNED) 7/8/04 (DATE)

HEATER ELECTRICAL CHECKS
(4-PIN CONNECTOR)

A TO B: .524 | C TO D: .571 KOHM

BEFORE POTTING, IN AIR,
750 ~~1500~~ VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
750 ~~1500~~ VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
750 ~~1500~~ VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

D. ANDERSON (SIGNED) 8/23/04 (DATE)

AFTER POTTING, IN HELIUM,
720 VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
720 VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
720 VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

REVIEWED Jon Zbasnik DATE 8/31/04
JON ZBASNIK
APPROVED Joseph Rasson DATE 9/1/04
JOSEPH RASSON

LIQUID HELIUM VESSEL DIAGNOSTIC PROBE TRAVELER

VIBROMETER FLANGE SER	AA 76408

"C" LEAK RATE: 4.8 X10^{-9} STD CC/SEC (HELIUM) BY D. ANDERSON, DATE 3/2/04

USED IN	DFBX G
CERNOX SERIAL NUMBER	CS-LS-X 18377
(ATTACH COPY OF COMPLETED CERN TRAVELER)	
LEVEL SENSOR SERIAL NUMBERS	HD100- 4, HD400- 5
LEVEL SENSORS POSITIONED PER 27A412A	DAVE ANDERSON (SIGNED) 6/21/04 (DATE)

LEVEL SENSOR RESISTANCE CHECKS (2-WIRE HP 3478A)
(16-PIN CONNECTOR)

A TO B: 76.03	A TO C: 2.96	A TO D: 75.31
B TO C: 78.51	B TO D: 1.54	C TO D: 77.77

E TO F: 18.99	E TO G: 3.60	E TO H: 18.79
F TO G: 22.10	F TO H: .661	G TO H: 21.89

A TO J: OVL MOHMS	E TO J: OVL MOHMS

DAVE ANDERSON
(SIGNED)
7/8/04
(DATE)

HEATER ELECTRICAL CHECKS
(4-PIN CONNECTOR)

A TO B: .565	C TO D: .533

KOHMS

BEFORE POTTING, IN AIR,
1500 VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
1500 VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
1500 VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

DAVE ANDERSON
(SIGNED)
7/29/04
(DATE)

AFTER POTTING, IN HELIUM,
720 VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
720 VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
720 VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

DAVE ANDERSON
8/3/04

REVIEWED Jon Zbasnik DATE 8/31/04
JON ZBASNIK
APPROVED DATE 9/1/04
JOSEPH RASSON

LIQUID HELIUM VESSEL DIAGNOSTIC PROBE TRAVELER

VIBROMETER FLANGE SER	AA_76393
"0" LEAK RATE: 3.6 X10-10 STD CC/SEC (HELIUM) BY D. ANDERSON, DATE 8-17-04	
USED IN	DFBX G
CERNOX SERIAL NUMBER	CS-LS-X_18380
(ATTACH COPY OF COMPLETED CERN TRAVELER)	
LEVEL SENSOR SERIAL NUMBERS	HD100- 6, HD400- 2
LEVEL SENSORS POSITIONED PER 27A412A	DAVE ANDERSON (SIGNED) 6/28/04 (DATE)

LEVEL SENSOR RESISTANCE CHECKS (2-WIRE HP 3478A)
(16-PIN CONNECTOR)

A TO B: 76.34	A TO C: 2.57	A TO D: 75.56
B TO C: 78.39	B TO D: 1.50	C TO D: 77.72

E TO F: 19.04	E TO G: 2.93	E TO H: 18.82
F TO G: 21.42	F TO H: .66	G TO H: 21.27

A TO J: OVL MOHMS	E TO J: OVL MOHMS

D. ANDERSON
(SIGNED)
8/12/04
(DATE)

HEATER ELECTRICAL CHECKS
(4-PIN CONNECTOR)

A TO B: .569	C TO D: .509

BEFORE POTTING, IN AIR,
1500 VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
1500 VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
1500 VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

D. ANDERSON
(SIGNED)
8-17-04
(DATE)

AFTER POTTING, IN HELIUM,
720 VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
720 VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
720 VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

D. ANDERSON
8-24-04

REVIEWED Jon Zbasnik DATE 8/31/04
JON ZBASNIK
APPROVED DATE 9/1/04
JOSEPH RASSON

LIQUID HELIUM VESSEL DIAGNOSTIC PROBE TRAVELER

VIBROMETER FLANGE SER	AA 76392
"0" LEAK RATE: 3.2 X10^{-9} STD CC/SEC (HELIUM) BY D. ANDERSON, DATE 8/4/04	
USED IN	DFBX D
CERNOX SERIAL NUMBER	CS-LS-X 18376
(ATTACH COPY OF COMPLETED CERN TRAVELER)	
LEVEL SENSOR SERIAL NUMBERS	HD100- 1, HD400- 6
LEVEL SENSORS POSITIONED PER 27A412A	D. ANDERSON (SIGNED) 6/21/04 (DATE)

LEVEL SENSOR RESISTANCE CHECKS (2-WIRE HP 3478A)
(16-PIN CONNECTOR)

A TO B: 76.20	A TO C: 2.96	A TO D: 75.54
B TO C: 78.75	B TO D: 1.55	C TO D: 77.95

E TO F: 19.71	E TO G: 3.51	E TO H: 19.20
F TO G: 22.45	F TO H: .695	G TO H: 22.18

A TO J: OVL MOHMS	E TO J: OVL MOHMS

D. Anderson
(SIGNED)
7/26/04
(DATE)

HEATER ELECTRICAL CHECKS
(4-PIN CONNECTOR)

A TO B: .553	C TO D: .566

KOHM

BEFORE POTTING, IN AIR,
1500 VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
1500 VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
1500 VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

Dave Anderson
(SIGNED)
7/29/04
(DATE)

AFTER POTTING, IN HELIUM,
720 VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
720 VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
720 VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

Dave Anderson
8/4/04

REVIEWED Jon Zbasnik DATE 8/31/04
JON ZBASNIK
APPROVED DATE 9/1/04
JOSEPH RASSON

LIQUID HELIUM VESSEL DIAGNOSTIC PROBE TRAVELER

VIBROMETER FLANGE SER	AA_76403

"C"

LEAK RATE: 2.6 X10^{-9} STD CC/SEC (HELIUM) BY ANDERSON, DATE 8/17/04

USED IN	DFBX F
CERNOX SERIAL NUMBER	CS-LS-X 18380
(ATTACH COPY OF COMPLETED CERN TRAVELER)	
LEVEL SENSOR SERIAL NUMBERS	HD100-2, HD400-1
LEVEL SENSORS POSITIONED PER 27A412A	D. ANDERSON (SIGNED) 6/21/04 (DATE)

LEVEL SENSOR RESISTANCE CHECKS (2-WIRE HP 3478A)
(16-PIN CONNECTOR)

A TO B: 76.13	A TO C: 2.67	A TO D: 75.45
B TO C: 78.57	B TO D: 1.54	C TO D: 77.58

E TO F: 19.40	E TO G: 2.92	E TO H: 19.17
F TO G: 21.37	F TO H: .669	G TO H: 21.22

A TO J: OVL MOHMS	E TO J: OVL MOHMS

D. ANDERSON
(SIGNED)
7/26/04
(DATE)

HEATER ELECTRICAL CHECKS
(4-PIN CONNECTOR)

A TO B: .518	C TO D: .523

BEFORE POTTING, IN AIR,
1500 VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
1500 VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
1500 VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

AFTER POTTING, IN HELIUM,
720 VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
720 VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
720 VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

D. ANDERSON
(SIGNED)
8/24/04
(DATE)

REVIEWED Jon Zbasnik DATE 8/31/04
JON ZBASNIK
APPROVED DATE 9/1/04
JOSEPH RASSON

LIQUID HELIUM VESSEL DIAGNOSTIC PROBE TRAVELER

VIBROMETER FLANGE SER	AA 76394
LEAK RATE: 5.4 $X10^{-10}$ STD CC/SEC (HELIUM) BY ANDERSON, DATE 8-17-04	
USED IN	DFBX E
CERNOX SERIAL NUMBER	CS-LS-X 8375
(ATTACH COPY OF COMPLETED CERN TRAVELER)	
LEVEL SENSOR SERIAL NUMBERS	HD100- 5, HD400- 4
LEVEL SENSORS POSITIONED PER 27A412A	D. ANDERSON (SIGNED) 6/21/04 (DATE)

VO

LEVEL SENSOR RESISTANCE CHECKS (2-WIRE HP 3478A)
(16-PIN CONNECTOR)

A TO B: 75.97	A TO C: 3.02	A TO D: 75.20
B TO C: 78.51	B TO D: 1.45	C TO D: 77.82

E TO F: 19.35	E TO G: 3.49	E TO H: 19.10
F TO G: 22.40	F TO H: .67	G TO H: 22.22

A TO J: OVL MOHMS	E TO J: OVL MOHMS

D. ANDERSON
(SIGNED)
8/13/04
(DATE)

HEATER ELECTRICAL CHECKS
(4-PIN CONNECTOR)

A TO B: .553	C TO D: .555

BEFORE POTTING, IN AIR,
720 ~~1500~~ VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
720 ~~1500~~ VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
720 ~~1500~~ VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

D. ANDERSON
(SIGNED)
8/17/04
(DATE)

AFTER POTTING, IN HELIUM,
720 VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
720 VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
720 VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

D. ANDERSON
8/26/04

REVIEWED Jon Zbasnik DATE 8/31/04
JON ZBASNIK
APPROVED DATE 9/1/04
JOSEPH RASSON

LIQUID HELIUM VESSEL DIAGNOSTIC PROBE TRAVELER

VIBROMETER FLANGE SER	AA76389
LEAK RATE: 1.0 X10^{-9} STD CC/SEC (HELIUM) BY D. ANDERSON, DATE 8/17/04	
USED IN	DFBX A
CERNOX SERIAL NUMBER	CS-LS-X 18378
(ATTACH COPY OF COMPLETED CERN TRAVELER)	
LEVEL SENSOR SERIAL NUMBERS	HD100-3, HD400-8
LEVEL SENSORS POSITIONED PER 27A412A	D. ANDERSON (SIGNED) 6/21/04 (DATE)

LEVEL SENSOR RESISTANCE CHECKS (2-WIRE HP 3478A)
(16-PIN CONNECTOR)

A TO B: 76.39	A TO C: 3.10	A TO D: 75.67
B TO C: 79.06	B TO D: 1.57	C TO D: 78.24

E TO F: 18.97	E TO G: 3.26	E TO H: 18.76
F TO G: 21.77	F TO H: .703	G TO H: 21.53

A TO J: OVL MOHMS	E TO J: OVL MOHMS

D. ANDERSON
(SIGNED)
8/13/04
(DATE)

HEATER ELECTRICAL CHECKS
(4-PIN CONNECTOR)

A TO B: .554	C TO D: .565

BEFORE POTTING, IN AIR,
1500 VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
1500 VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
1500 VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

D. ANDERSON
(SIGNED)
8/17/04
(DATE)

AFTER POTTING, IN HELIUM,
720 VAC A+B TO C+D FOR I HR OK? ✓ Y ___ N
720 VAC A+B TO GROUND FOR I HR OK? ✓ Y ___ N
720 VAC C+D TO GROUND FOR I HR OK? ✓ Y ___ N

D. ANDERSON
8/24/04

REVIEWED Jon Zbasnik DATE 8/31/04
JON ZBASNIK
APPROVED DATE 9/1/04
JOSEPH RASSON

Cryogenic Thermometer Traveller

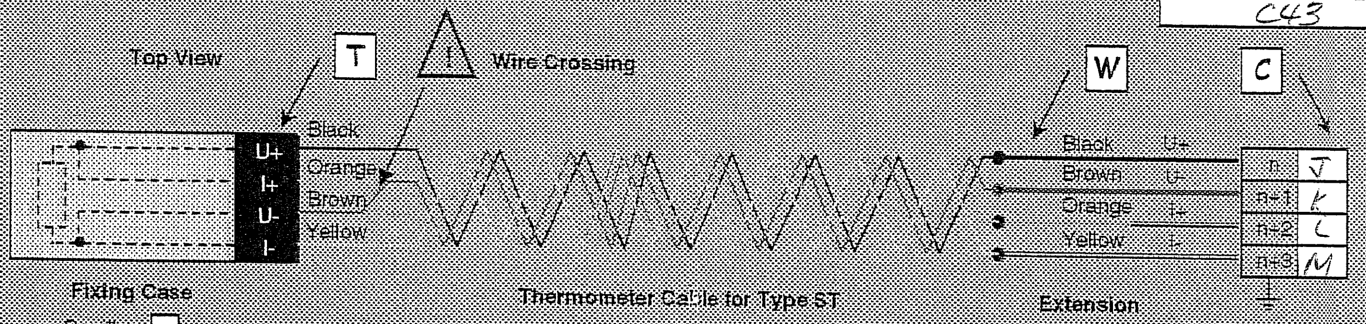
DESCRIPTION*

Part Description:	Cryogenic thermometer	**Instrument Name:**	VIBRO-METER
CERN Part Identifier:	HCQITESCXT-CR016190	**Top Assembly:**	AN76389
Other Identification:	CX_LS_X18378	**Functional Equipment Identifier:**	DFBXA

* In accordance with LHC-QIT-QA-0002

CABLING

Connector Tag Name: C43



Fixing Case

Capillary ☐
Hole ☐
Stud ☒

Thermometer Cable for Type ST

ρ (300 K) = 38 Ohm/m
Manganin AWG 36
Length = 3 m

Extension

ρ (300 K) = 0.07 Ohm/m
Copper AWG 24
Length: 8cm

CHECKS

Intervention	Date DD-MMM-YYYY	Check Point	R(U+,U-,I+,I-) [Ohm] 4W	R(U-,I-) [Ohm] 2W	R(U+,I+) [Ohm] 2W	R(U+,GND) [Ohm] 2W	Temperature [K]	Firm/Laboratory	Checked by
Reference	11-Feb-2002	T	61.52	0.67	0.50	OVL	300.00	IPN	Joly
Expedition	2-Sep-2003	T	60.14	0.67	0.50	OVL	293.00	CERN	Vauthier
Reception		T W C							
~~CABLE~~	~~22 JUNE 2004~~	W	~~62.20~~	~~253.05~~			~~20°C~~	~~LBNL~~	~~ANDERSON~~
CABLE	22 JUNE 2004	W	61.10	254.04	251.84	OVL	20 °C	LBNL	ANDERSON
		T W C							
		T W C							
		T W C							
		T W C							
		T W C							
		T W C							
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		T W C							

Cryogenic Thermometer Traveller

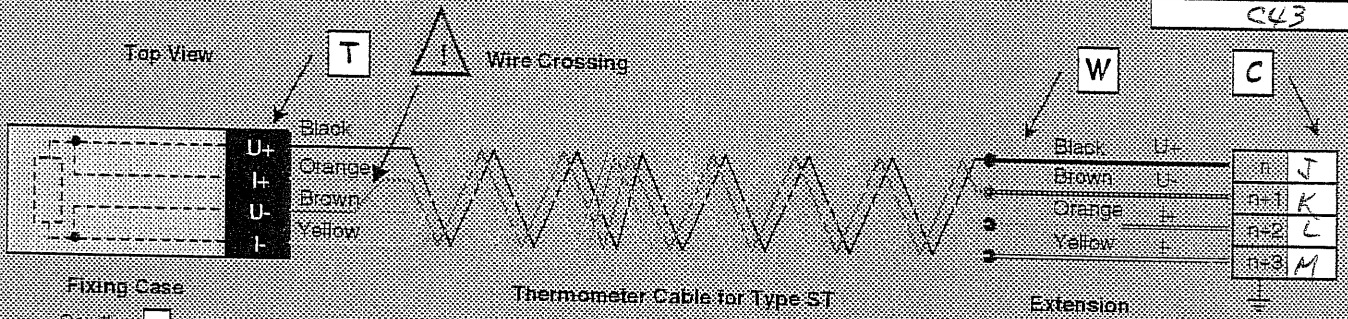
DESCRIPTION*

Part Description:	Cryogenic thermometer	**Instrument Name:**	VIBRO-METER
CERN Part Identifier:	HCQITESCXT-CR016150	**Top Assembly:**	AA 76390
Other Identification:	CX_LS_X18374	**Functional Equipment Identifier:**	DFBX B

* In accordance with LHC-QIT-QA-0002

CABLING

Connector Tag Name: C43



Fixing Case

Capillary ☐
Hole ☐
Stud ☒

Thermometer Cable for Type ST

ρ (300 K) = 38 Ohm/m
Manganin AWG 36
Length = 3 m

Extension

ρ (300 K) = 0.07 Ohm/m
Copper AWG 24
Length: 8cm

CHECKS

Intervention	Date/ DD-MMM-YYYY	Check Point	R(U+,U-,I+,I-) [Ohm] 4W	R(U-,I-) [Ohm] 2W	R(U+,I+) [Ohm] 2W	R(U+,GND) [Ohm] 2W	Temperature [K]	Firm/Laboratory	Checked by
Reference	11-Feb-2002	T	62.35	0.61	0.50	OVL	300.00	IPN	Joly
Montage Fil	2-Sep-2003	T	61.21	0.61	0.50	OVL	293.00	CERN	Vauthier
Expedition	2-Sep-2003	W	61.22	252.60	250.30	OVL	293.00	CERN	Vauthier
Reception		T W C							
CABLIE	22 JUNE 2004	T W C	62.20	253.05	250.08	OVL	20° C	LBNL	ANDERSON
		T W C							
		T W C							
		T W C							
		T W C							
		T W C							
		T W C							
		T W C							
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		T W C							

Cryogenic Thermometer Traveller

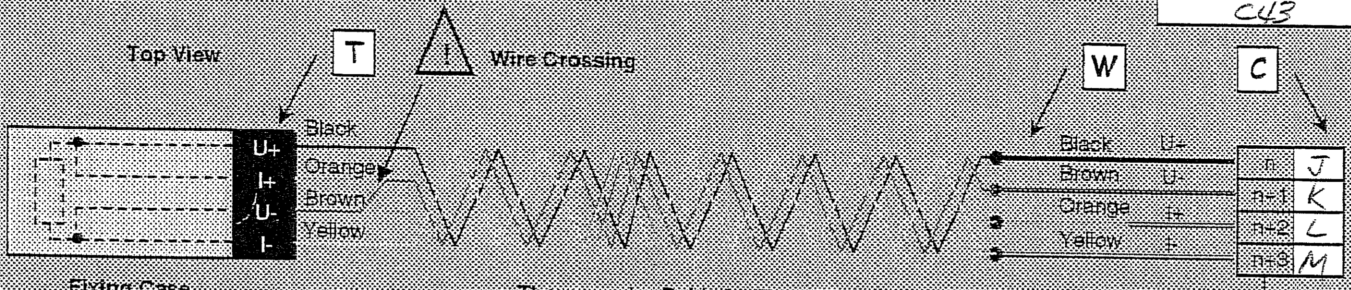
DESCRIPTION*

Part Description:	Cryogenic thermometer	**Instrument Name:**	VIBRO-METER
CERN Part Identifier:	HCQITESCXT-CR016210	**Top Assembly:**	AA76393
Other Identification:	CX_LS_X18380	**Functional Equipment Identifier:**	DFBXC

* In accordance with LHC-QIT-QA-0002

CABLING

Connector Tag Name
C43



Fixing Case
Capillary ☐
Hole ☐
Stud ☒

Thermometer Cable for Type ST
ρ (300 K) = 38 Ohm/m
Manganin AWG 36
Length = 3 m

Extension
ρ (300 K) = 0.07 Ohm/m
Copper AWG 24
Length: 8cm

CHECKS

Intervention	Date DD-MMM-YYYY	Check Point	R(U+,U-,I+,I-) [Ohm] 4W	R(U-,I-) [Ohm] 2W	R(U+,I+) [Ohm] 2W	R(U-, GND) [Ohm] 2W	Temperature [K]	Firm/Laboratory	Checked by
Reference	11-Feb-2002	T	62.88	0.66	0.49	OVL	300.00	IPN	Joly
Expedition	2-Sep-2003	T	61.50	0.66	0.49	OVL	293.00	CERN	Vauthier
Reception		T W C							
CABLE	22 JUNE 2004	W	62.45	252.41	248.48	OVL	20°C	LBNL	ANDERSON
		T W C							
		T W C							
		T W C							
		T W C							
		T W C							
		T W C							
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		T W C							

Cryogenic Thermometer Traveller

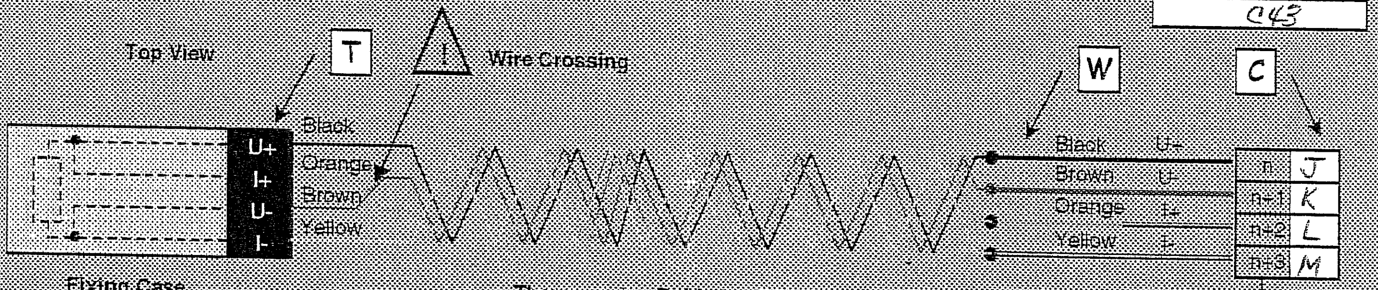
DESCRIPTION*

Part Description:	Cryogenic thermometer	**Instrument Name:**	VIBRO-METER
CERN Part Identifier:	HCQITESCXT-CR016170	**Top Assembly:**	AA76 392
Other Identification:	CX_LS_X18376	**Functional Equipment Identifier:**	DFBXD

* In accordance with LHC-QIT-QA-0002

CABLING

Connector Tag Name
C43



Fixing Case
Capillary ☐
Hole ☐
Stud ☐

Thermometer Cable for Type ST
ρ (300 K) = 38 Ohm/m
Manganin AWG 36
Length = 3 m

Extension
ρ (300 K) = 0.07 Ohm/m
Copper AWG 24
Length: 8cm

CHECKS

Intervention	Date/ DD-MMM-YYYY	Check Point	R(U+,U-,I+,I-) [Ohm] 4W	R(U+,I+) [Ohm] 2W	R(U-,I-) [Ohm] 2W	R(U+,GND) [Ohm] 2W	Temperature [K]	Firm/Laboratory	Checked by
Reference	11-Feb-2002	T	60.65	0.65	0.50	OVL	300.00	IPN	Joly
Expedition	2-Sep-2003	T	59.35	0.65	0.50	OVL	293.00	CERN	Vauthier
Reception		W							
CABLE	22 JUNE 2004	W	6620	253.18	249.55	OVL	22° C	LBNL	ANDERSON
		T W C							
		T W C							
		T W C							
		T W C							
		T W C							
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Cryogenic Thermometer Traveller

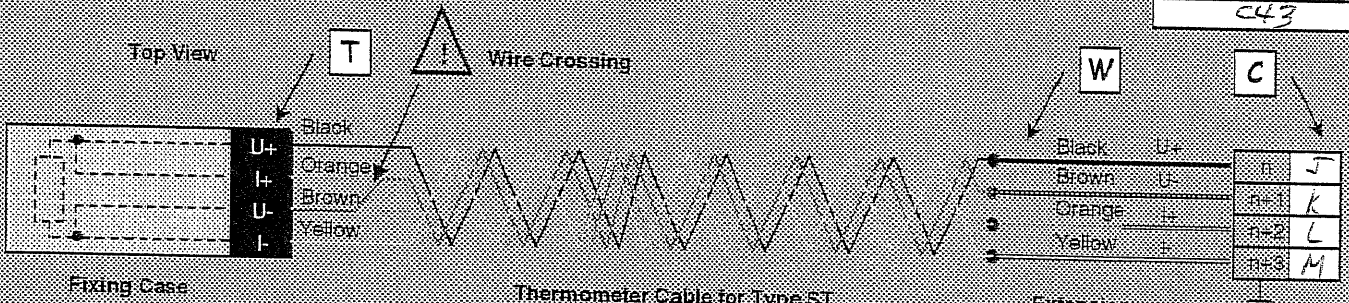
DESCRIPTION*

Part Description:	Cryogenic thermometer
CERN Part Identifier:	HCQITESCXT-CR016160
Other Identification:	CX_LS_X18375
Instrument Name:	VIBRO-METER
Top Assembly:	AA76394
Functional Equipment Identifier:	DFBX E

* In accordance with LHC-QIT-QA-0002

CABLING

Connector Tag Name: C43



Fixing Case
Capillary ☐
Hole ☐
Stud ☒

Thermometer Cable for Type ST
ρ (300 K) = 38 Ohm/m
Manganin AWG 36
Length = 3 m

Extension
ρ (300 K) = 0.07 Ohm/m
Copper AWG 24
Length: 8cm

CHECKS

Intervention	Date/ DD-MMM-YYYY	Check Point	R(U+,U-,I+,I-) [Ohm] 4W	R(U-,I-) [Ohm] 2W	R(U+,I+) [Ohm] 2W	R(U+,GND) [Ohm] 2W	Temperature [K]	Firm/Laboratory	Checked by
Reference	11-Feb-2002	T	62.18	0.62	0.50	OVL	300.00	IPN	Joly
Montage Fil	2-Sep-2003	T	61.00	0.62	0.50	OVL	293.00	CERN	Vauthier
Expedition	2-Sep-2003	W	60.99	254.00	250.20	OVL	293.00	CERN	Vauthier
Reception		T W C							
CABLE	22 JUNE 2004	W	61.86	254.20	250.66	OVL	20°C	LBNL	ANDERSON
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Cryogenic Thermometer Traveller

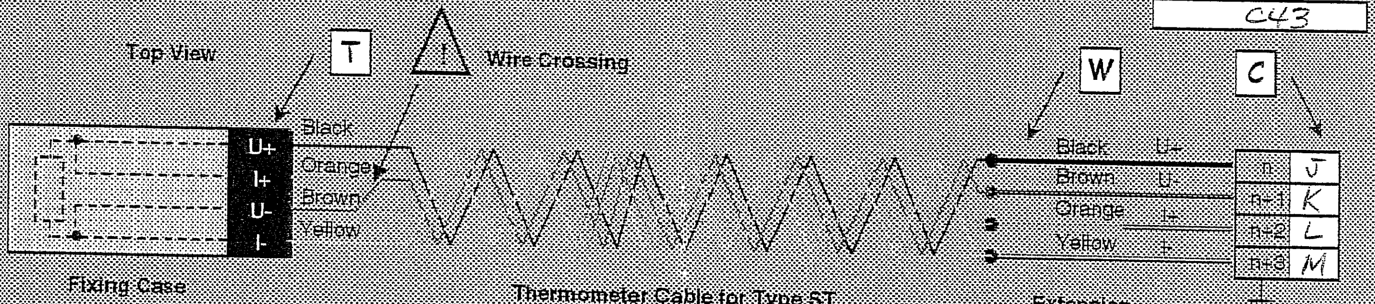
DESCRIPTION*

Part Description:	Cryogenic thermometer	**Instrument Name:**	VIBROMETER
CERN Part Identifier:	HCQITESCXT-CR016220	**Top Assembly:**	AR76403
Other Identification:	CX_LS_X18381	**Functional Equipment Identifier:**	DFBXF

* In accordance with LHC-QIT-QA-0002

CABLING

Connector Tag Name
C43



Fixing Case

Capillary ☐
Hole ☐
Stud ☒

Thermometer Cable for Type ST

ρ (300 K) = 38 Ohm/m
Manganin AWG 36
Length = 3 m

Extension

ρ (300 K) = 0.07 Ohm/m
Copper AWG 24
Length: 8cm

CHECKS

Intervention	Date DD-MMM-YYYY	Check Point	R(U+,U-,I+,I-) [Ohm] 4W	R(U-,I-) [Ohm] 2W	R(U+,I+) [Ohm] 2W	R(U+,GND) [Ohm] 2W	Temperature [K]	Firm/Laboratory	Checked by
Reference	11-Feb-2002	T	62.47	0.66	0.49	OVL	300.00	IPN	Joly
Expedition	2-Sep-2003	T	61.28	0.66	0.49	OVL	293.00	CERN	Vauthier
Reception		T W C							
CABLE	22-June 2004	W	62.13	253.14	251.47	OVL	20° C	LBNL	Anderson
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Cryogenic Thermometer Traveller

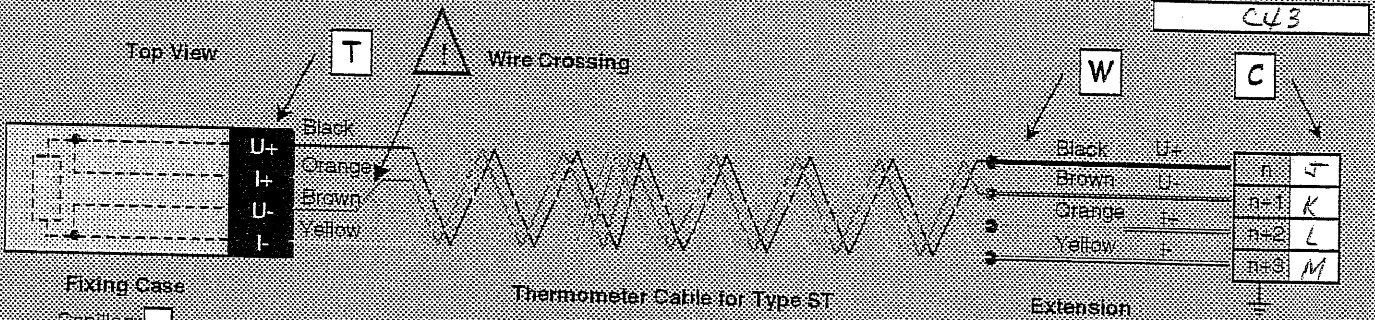
DESCRIPTION*

Part Description:	Cryogenic thermometer	**Instrument Name:**	VIBROMETER
CERN Part Identifier:	HCQITESCXT-CR016180	**Top Assembly:**	AA76408
Other Identification:	CX_LS_X18377	**Functional Equipment Identifier:**	DFBXG

* In accordance with LHC-QIT-QA-0002

CABLING

Connector Tag Name
C43



Fixing Case

Capillary ☐
Hole ☐
Stud ☐

Thermometer Cable for Type ST

ρ (300 K) = 38 Ohm/m
Manganin AWG 36
Length = 3 m

Extension

ρ (300 K) = 0.07 Ohm/m
Copper AWG 24
Length: 8cm

CHECKS

Intervention	Date/ DD-MMM-YYYY	Check Point	R(U+,U-,I+,I-) [Ohm] 4W	R(U+,U-) [Ohm] 2W	R(I+,I-) [Ohm] 2W	R(U+,GND) [Ohm] 2W	Temperature [K]	Firm/Laboratory	Checked by
Reference	11-Feb-2002	T	61.83	0.63	0.51	OVL	300.00	IPN	Joly
Expedition	2-Sep-2003	T	60.60	0.63	0.51	OVL	293.00	CERN	Vauthier
Reception		T W C							
CABLE	22 JUNE 2004	W	61.26	255.56	251.45	OVL	23° C	LBNL	ANDERSEN
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Cryogenic Thermometer Traveller

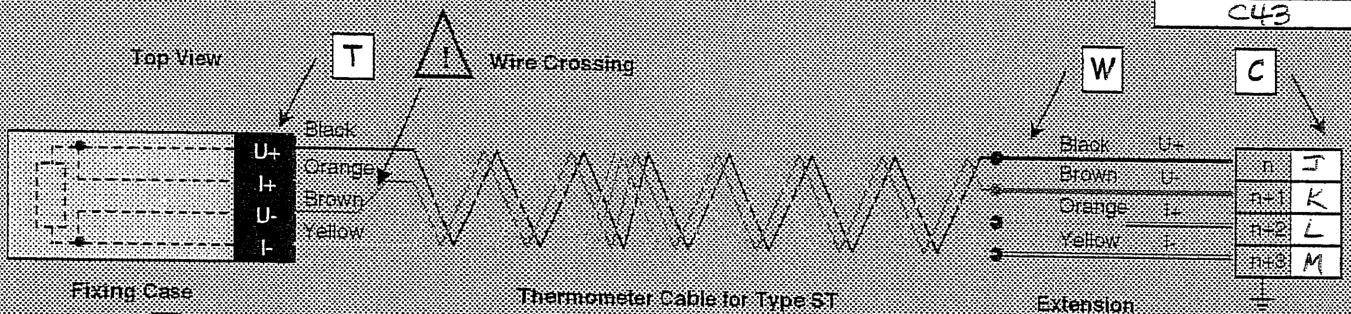
DESCRIPTION*

Part Description:	Cryogenic thermometer	**Instrument Name:**	VIBRO-METER
CERN Part Identifier:	HCQITESCXT-CR016200	**Top Assembly:**	AA76409
Other Identification:	CX_LS_X18379	**Functional Equipment Identifier:**	DFBXH

* In accordance with LHC-QIT-QA-0002

CABLING

Connector Tag Name
C43



Fixing Case
Capillary ☐
Hole ☐
Stud ☒

Thermometer Cable for Type ST
ρ (300 K) = 38 Ohm/m
Manganin AWG 36
Length = 3 m

Extension
ρ (300 K) = 0.07 Ohm/m
Copper AWG 24
Length: 8cm

CHECKS

Intervention	Date/ DD-MMM-YYYY	Check Point	R(U+,U-,I+,I-) [Ohm] 4W	R(U-,I-) [Ohm] 2W	R(U+,I+) [Ohm] 2W	R(U+,GND) [Ohm] 2W	Temperature [K]	Firm/Laboratory	Checked by
Reference	11-Feb-2002	T	62.53	0.64	0.51	OVL	300.00	IPN	Joly
Expedition	2-Sep-2003	T	61.12	0.64	0.51	OVL	293.00	CERN	Vauthier
Reception		T W C							
CABLE	22 JUNE 2004	T W C	61.86	254.06	251.85	OVL	24°C	LBNL	ANDERSEN
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